

CLAIMS

1. A substrate processing apparatus comprising:
a substrate holding mechanism for holding a substrate under a holding
5 force which is changed according to a rotational speed of said substrate holding
mechanism;
a substrate rotation mechanism for rotating said substrate holding
mechanism to rotate the substrate held by said substrate holding mechanism; and
a treatment liquid supply mechanism for supplying a treatment liquid to a
10 desired portion of the substrate held by said substrate holding mechanism.
2. The substrate processing apparatus as recited in claim 1, further
comprising a driving device for changing a rotational speed of said substrate
holding mechanism relative to a rotational speed of the substrate held by said
15 substrate holding mechanism.
3. A substrate processing apparatus comprising:
a substrate holding mechanism for holding a peripheral portion of a
substrate;
20 a base member having said substrate holding mechanism attached thereto,
said base member facing at least one surface of the substrate;
a rotatable shaft attached to a central portion of said base member;
a first liquid supply nozzle for selectively supplying a chemical liquid or a
first cleaning liquid to the substrate;
25 a switching device for switching the chemical liquid and the first cleaning
liquid to be supplied to said first nozzle;
a second liquid supply nozzle for supplying a second cleaning liquid to an
inner surface of said substrate holding mechanism and an upper surface of said base
member;
30 a gas supply nozzle for supplying a gas to a space between the substrate
and said base member; and
a nozzle structure including said first liquid supply nozzle, said second
liquid supply nozzle, and said gas supply nozzle, said nozzle structure being
disposed within said rotatable shaft.

4. The substrate processing apparatus as recited in claim 3, wherein said first liquid supply nozzle is configured to clean said first liquid supply nozzle, an outer surface of said nozzle structure, and vicinity thereof with the first cleaning liquid.

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5. The substrate processing apparatus as recited in claim 3, further comprising:

a first line connected to said first liquid supply nozzle;

a second line connected to said second liquid supply nozzle; and

10 a liquid discharge mechanism for discharging a liquid remaining in said first line and said second line.

6. The substrate processing apparatus as recited in claim 3, further comprising a purge gas supply line for supplying a purge gas to a gap between said
15 rotatable shaft and said nozzle structure.

7. The substrate processing apparatus as recited in claim 3, further comprising a third liquid supply nozzle for supplying a third cleaning liquid to an outer surface of said substrate holding mechanism.

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8. The substrate processing apparatus as recited in any one of claims 1 through 7, further comprising a scatter prevention cup disposed outside of said substrate holding mechanism so as to cover said substrate holding mechanism, said scatter prevention cup being movable in a vertical direction.

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9. A substrate processing method comprising:

holding a substrate by a substrate holding mechanism;

rotating the substrate holding mechanism by a substrate rotation mechanism to rotate the substrate; and

30 supplying a treatment liquid to a desired portion of the rotating substrate to process the substrate while changing a rotational speed of the substrate holding mechanism and a rotational speed of the substrate relative to each other.

10. The substrate processing method as recited in claim 9, wherein said changing a rotational speed of the substrate holding mechanism and a rotational speed of the substrate relative to each other comprises:

5 increasing or decreasing the rotational speed of the substrate holding mechanism to change the rotational speed of the substrate holding mechanism and the rotational speed of the substrate relative to each other.

11. The substrate processing method as recited in claim 10, wherein said changing a rotational speed of the substrate holding mechanism and a rotational speed of the substrate relative to each other further comprises:

10 stopping said supplying the substrate treatment liquid simultaneously with or after said increasing or decreasing the rotational speed of the substrate holding mechanism.

12. The substrate processing method as recited in claim 9, wherein said changing a rotational speed of the substrate holding mechanism and a rotational speed of the substrate relative to each other comprises:

15 changing the rotational speed of the substrate holding mechanism from a first rotational speed to a second rotational speed; and then
20 returning the rotational speed of the substrate holding mechanism from the second rotational speed to the first rotational speed.

13. A substrate processing method comprising:

25 holding a substrate by a substrate holding mechanism;
rotating the substrate holding mechanism by a substrate rotation mechanism to rotate the substrate;

supplying a treatment liquid to the rotating substrate to process the substrate;

30 rotating the substrate at a first high rotational speed after said supplying the treatment liquid;

supplying a cleaning liquid to at least one surface of the substrate rotated at the first high rotational speed to clean the treatment liquid attached to the substrate; and

35 removing a chemical liquid attached to at least one of the substrate holding mechanism and the substrate rotation mechanism in a state such that the at least one surface of the substrate is covered with the cleaning liquid.

14. The substrate processing method as recited in claim 13, wherein the first high rotational speed is in a range of 1000 to 3000 rpm.

15. The substrate processing method as recited in claim 13, further comprising rotating the substrate at a second high rotational speed to remove the cleaning liquid and dry the substrate.

16. The substrate processing method as recited in claim 15, wherein said rotating the substrate at a second high rotational speed comprises rotating the substrate at a high rotational speed substantially equal to the first high rotational speed for a desired period of time.

17. A substrate processing method comprising:
holding a substrate by a substrate holding mechanism;
15 rotating the substrate holding mechanism by a substrate rotation mechanism to rotate the substrate;
supplying a treatment liquid to the rotating substrate to process the substrate; and
supplying a cleaning liquid to the rotating substrate to clean the substrate
20 holding mechanism.

18. The substrate processing method as recited in claim 17, wherein said rotating the substrate holding mechanism comprises rotating the substrate holding mechanism at a rotational speed lower than 300 rpm during said supplying the
25 cleaning liquid.

19. A substrate processing method comprising:
holding a substrate by a substrate holding mechanism;
rotating the substrate holding mechanism by a substrate rotation
mechanism to rotate the substrate;
5 supplying a treatment liquid to the rotating substrate to process the
substrate;
rotating the substrate at a first high rotational speed after supplying the
treatment liquid;
supplying a cleaning liquid to at least one surface of the substrate rotated at
10 the first high rotational speed to clean the treatment liquid attached to the substrate;
removing a chemical liquid attached to at least one of the substrate holding
mechanism and the substrate rotation mechanism in a state such that the at least one
surface of the substrate is covered with the cleaning liquid;
supplying a cleaning liquid to the rotating substrate to clean the substrate
15 holding mechanism; and
rotating the substrate at a second rotational speed substantially equal to the
first high rotational speed for a desired period of time to remove the cleaning liquid
and dry the substrate.
- 20 20. The substrate processing method as recited in any one of claims 13
through 19, wherein the cleaning liquid comprises pure water, deaerated water, or
gas dissolved water.
21. The substrate processing method as recited in any one of claims 9
25 through 20, wherein supplying the treatment liquid comprises supplying the
treatment liquid to a peripheral portion of the substrate to remove a film formed on
the peripheral portion of the substrate.
22. The substrate processing method as recited in claim 21, wherein the
30 film to be removed comprises a film containing one of Cu, Co, Co alloy, Ta, Ta-N,
W, W-N, Ti, Ti-N, Ni, Ru, P, B, and Mo, or a film having a plurality of layers each
containing one of Cu, Co, Co alloy, Ta, Ta-N, W, W-N, Ti, Ti-N, Ni, Ru, P, B, and
Mo.

23. A substrate processing method comprising:
holding a substrate by a substrate holding mechanism;
rotating the substrate holding mechanism by a substrate rotation
mechanism to rotate the substrate;
5 supplying a treatment liquid to the rotating substrate to process the
substrate;
supplying a chemical liquid from a first liquid supply nozzle to the
substrate;
switching a liquid to be supplied from the first liquid supply nozzle into a
10 cleaning liquid;
supplying the cleaning liquid to the substrate;
supplying a cleaning liquid to the first liquid supply nozzle and vicinity of
the first liquid supply nozzle to clean the first liquid supply nozzle and vicinity of
the first liquid supply nozzle; and
15 rotating the substrate holding mechanism to remove a liquid attached to the
substrate and dry the substrate.

24. The substrate processing method as recited in claim 23, further
comprising:
20 stopping said supplying the cleaning liquid; and
discharging a liquid remaining in the first liquid supply nozzle and a line
connected to the first liquid supply nozzle after said stopping and before said drying
the substrate.

25. The substrate processing method as recited in claim 23, further
comprising:
25 supplying a cleaning liquid from a second liquid supply nozzle, before said
drying the substrate, to clean an inner surface of the substrate holding mechanism
and an upper surface of a base member having the substrate holding mechanism
30 attached thereon.

26. The substrate processing method as recited in claim 23, further comprising:

supplying a gas from a gas supply nozzle to a space between the substrate and a base member having the substrate holding mechanism attached thereon during
5 said drying the substrate.

27. The substrate processing method as recited in claim 26, further comprising:

supplying the gas from the gas supply nozzle to the space between the
10 substrate and the base member during said cleaning the first liquid supply nozzle and the vicinity thereof.